

Renewable Energy Impact on Transportation

Background - Renewable Energy in Transportation

- Provides long term transportation energy security
 - Hydrogen (from electrolysis) vehicles
 - Electric vehicles
 - Grid connected hybrid electric vehicles
- Other energy sources are finite
 - Depending on growth assumptions, petroleum, natural gas, and U.S. coal could all be depleted in 75 years*
- Provides low emissions

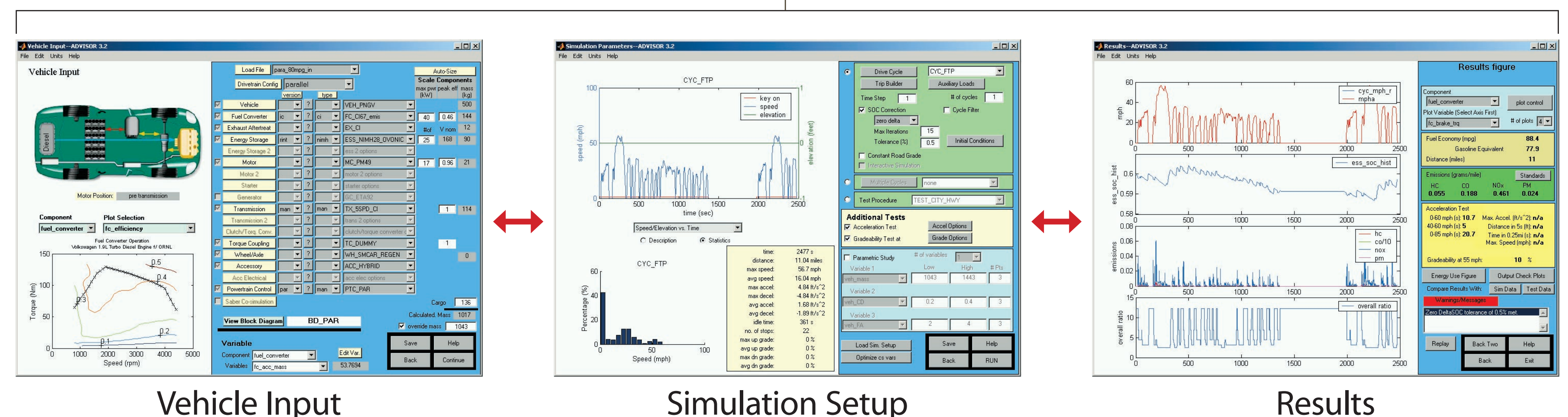
*Source: Weisz, Physics Today, p. 47, July 2004

Part of the Solution, ADVISOR[®] - ADvanced Vehicle SimulatOR

- Models hybrid electric (parallel, series), conventional and electric vehicle powertrains
 - Predicts vehicle fuel consumption and performance attributes
 - Primary role is to provide relative impacts of powertrain configuration and energy management options including interactions between components within the overall vehicle
- Programmed in MATLAB/Simulink environment
 - Open source code

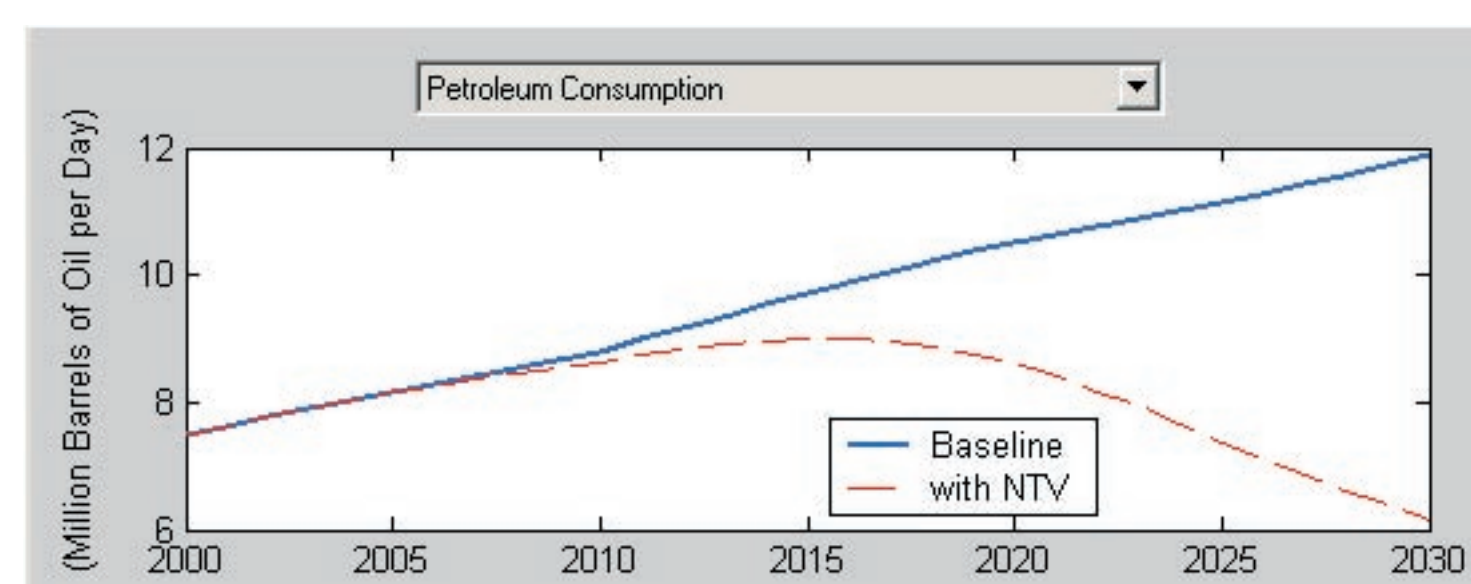


ADVISOR - Three Main GUI Screens



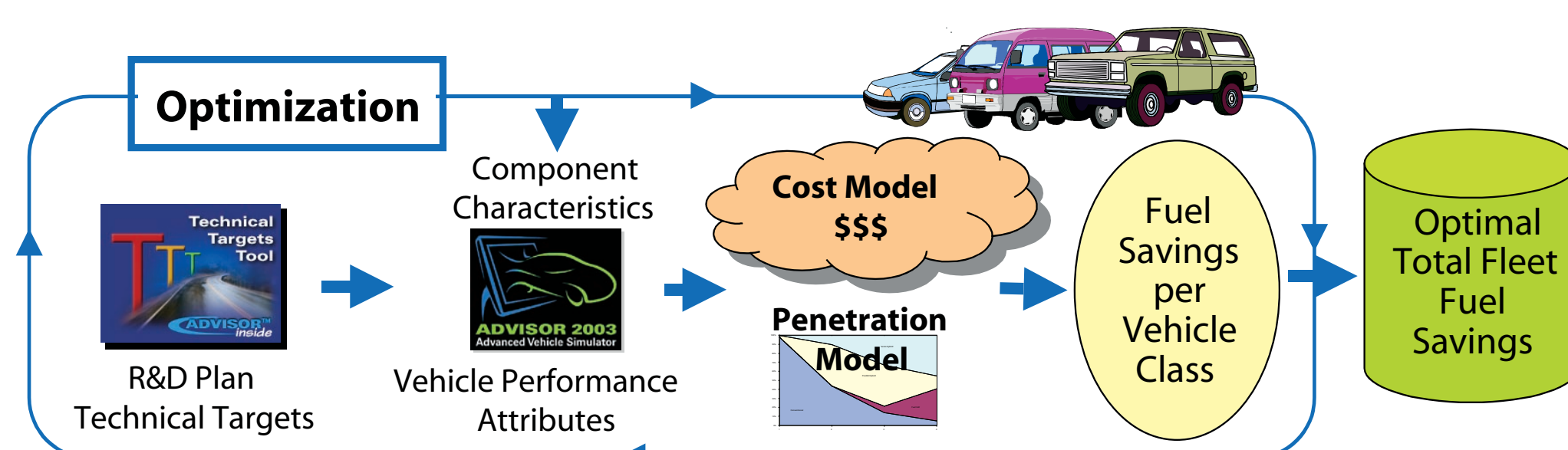
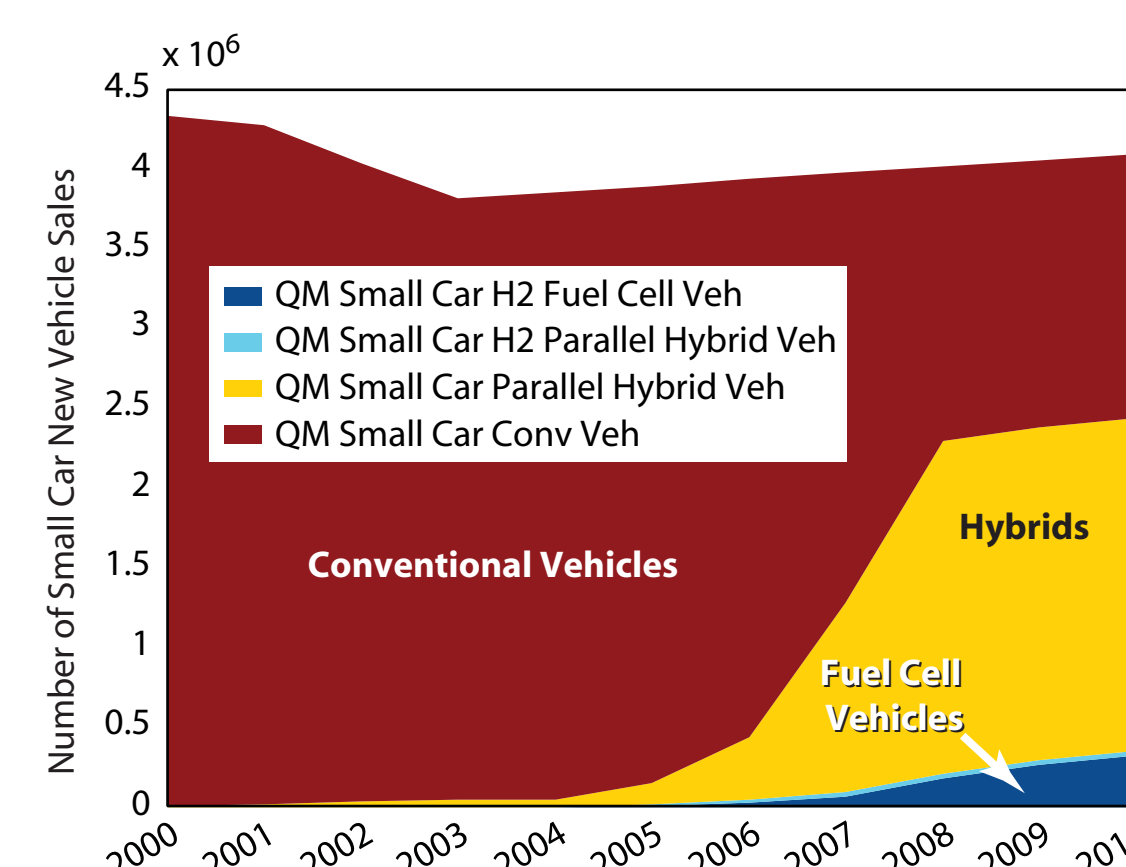
ADVISOR Application: Technical Targets Analysis

- Provides a high-level analysis of the DOE research efforts
 - Assesses the sensitivity of fuel economy and national petroleum consumption to component technology attributes
- Links to ADVISOR for vehicle performance predictions
- Incorporates analysis inputs from cost and market penetration modeling efforts under other DOE activities
- Models changes in national fleet consumption over time across multiple platforms, including competition among technology options



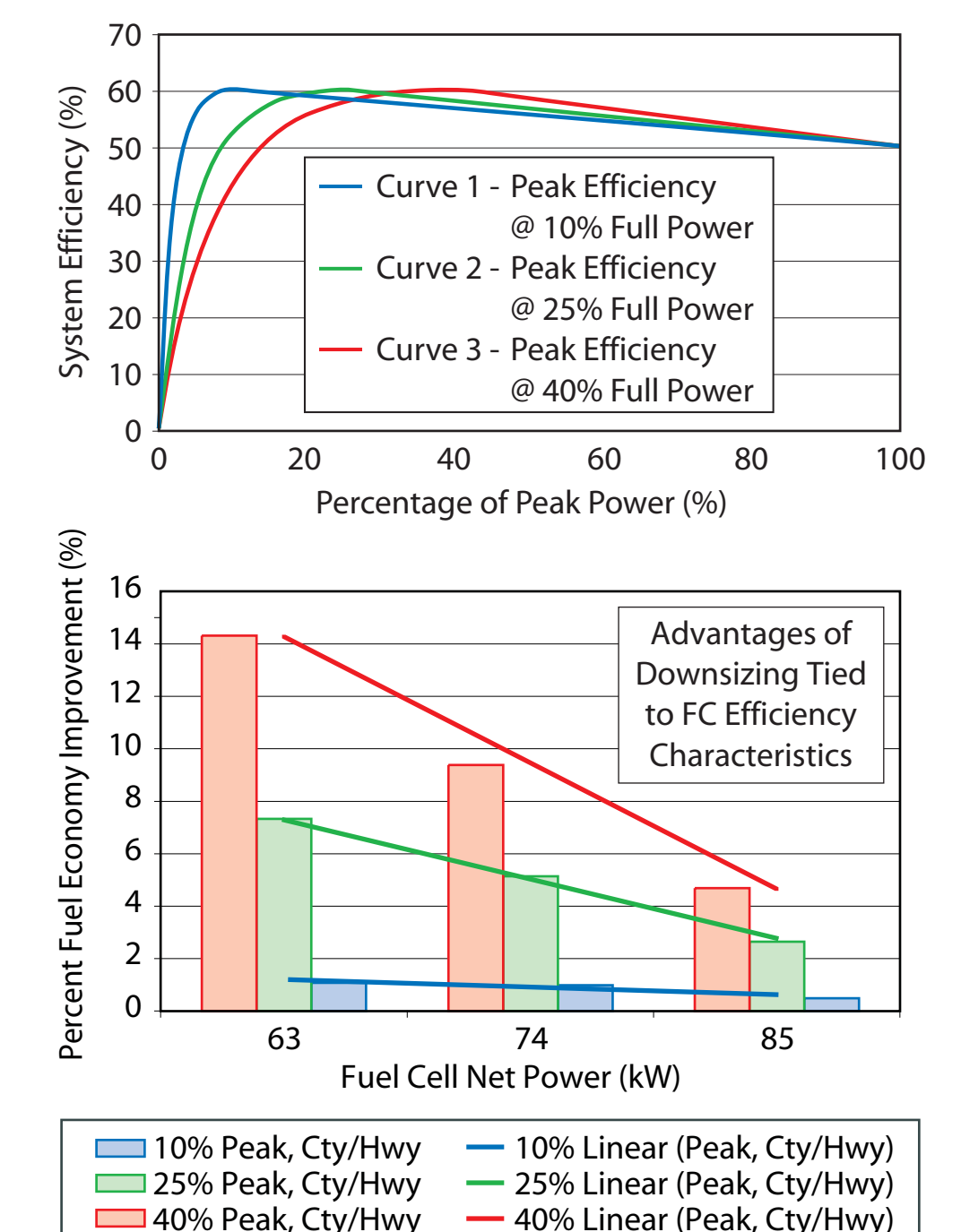
Technical Targets Analysis: New Technologies Compete for Vehicle Sales

- Optimization routine solves for best vehicle configuration to maximize petroleum displacement
- Predicts hybrids will gain significant market share over time
- If not limited by infrastructure, fuel cell vehicles will begin to penetrate

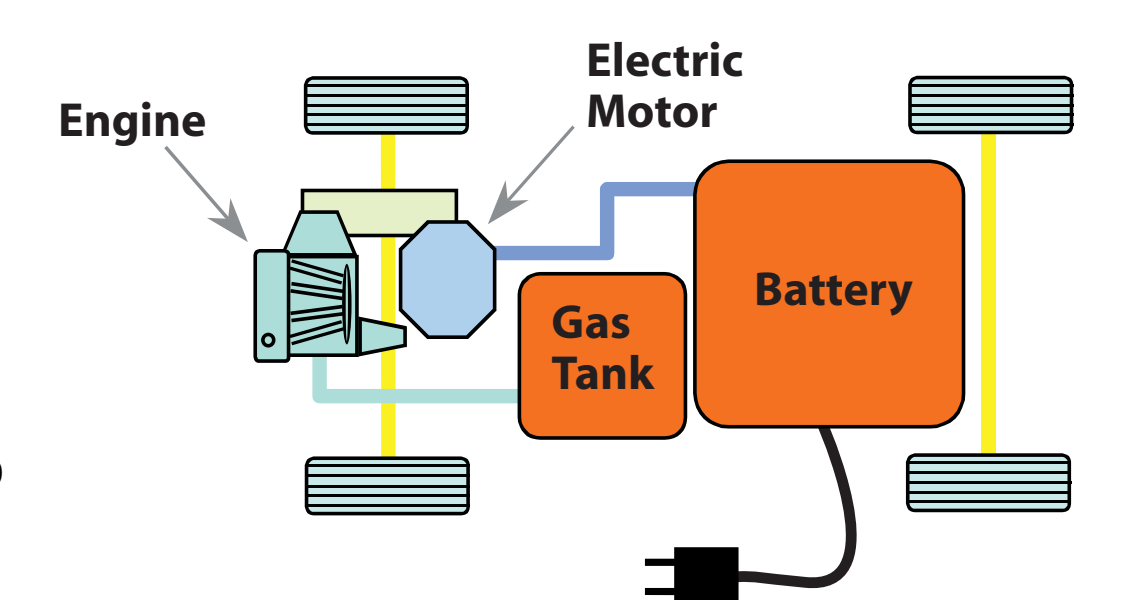
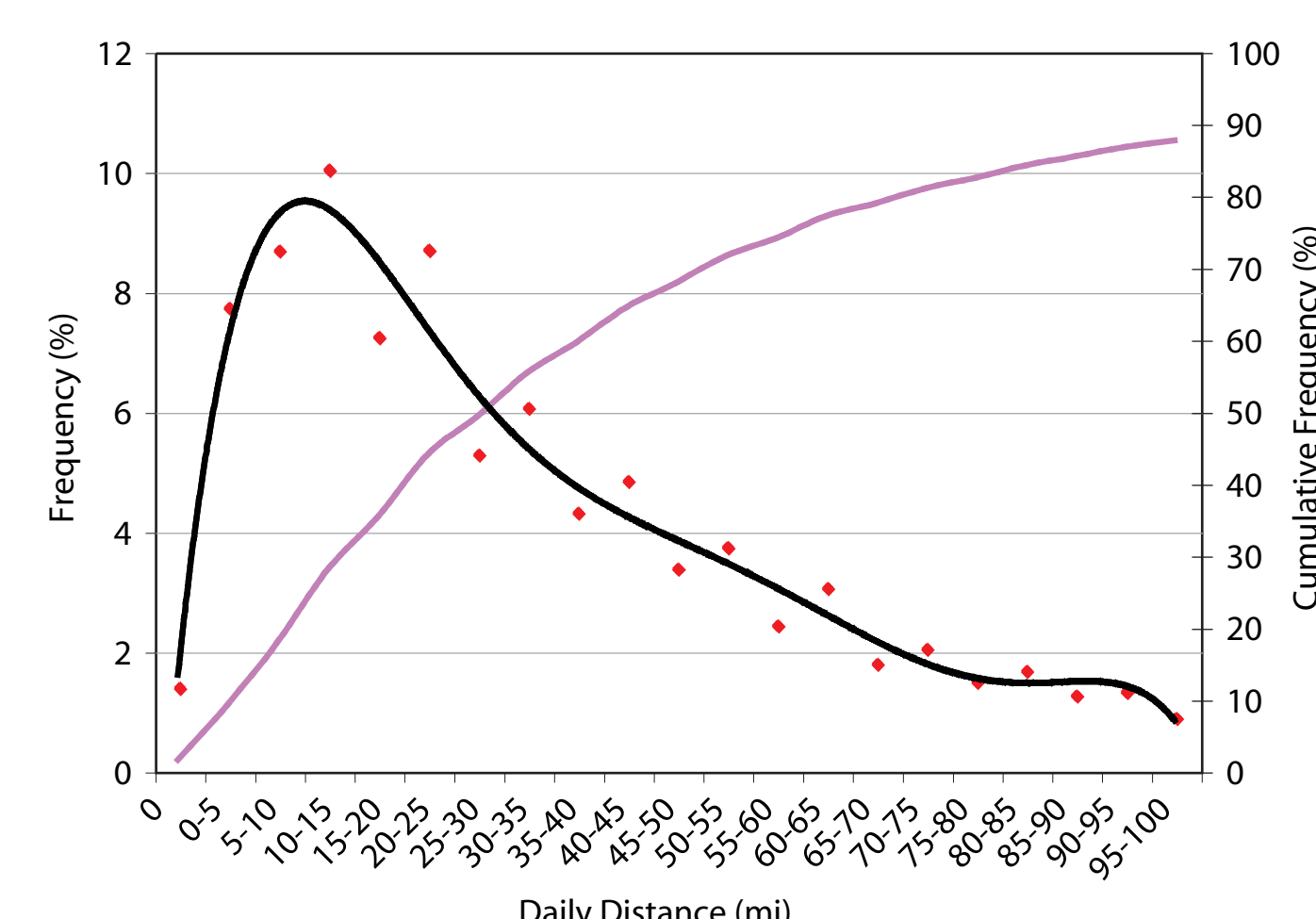


ADVISOR Application: Energy Storage Requirements for Fuel Cell Hybrid Vehicles

- Collaboration with FreedomCAR Energy Storage and Fuel Cell technical teams to...
 - Determine energy storage requirements for best vehicle performance
 - Understand how fuel cell system attributes affect these requirements
- Accomplishments
 - Technical papers published at AABC-03 and AABC-04
 - Thorough analysis of range of vehicle scenarios to provide confidence in conclusions



ADVISOR Application: Grid Connected Hybrid Vehicle Analysis



- What HEV configuration best fits the consumer's needs?
- Grid-connected hybrids have the potential to save fuel and enhance our energy security through distributed resources

Conclusions

- ADVISOR plays a key role in helping DOE and industry understand hybrid vehicle systems integration and optimization opportunities
- We work with industry partners to address critical technical barriers to more efficient vehicle technologies



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